Record Hill Wind, LLC // Natural Resources Protection Act
Construction of 50.6 megawatt wind energy development - Roxbury

Excerpts from the Department's License Record – Stormwater

- Excerpts from application (12/02/08)
- Excerpt from application – Revision to Stormwater Management Plan (07/10/09)
- DEP Review Comment (07/28/09)

Section 12
Stormwater

James W. Sewall Company (Sewall) has developed, as part of the turbine site and road plans, a comprehensive stormwater management and control plan for the Record Hill Wind Project (Project). This plan was developed in conjunction with concurrent filing of a Notice of Intent (NOI) for this Project for coverage under the Maine Construction General Permit that is part of the Site Location of Development

The construction of gravel roads, tower foundations, and pads may create stormwater runoff in excess of what the Project area presently generates. It is important to mitigate this increase in stormwater runoff to prevent erosion or damage to downgradient ecosystems. In general, the stormwater control plan is designed to minimize the concentration of stormwater flows off the Project site. The primary components of the plan include minimizing the permanently impacted areas of the project site and incorporating appropriate Best Management Practices (BMPs) in the project design.

The primary effort in stormwater management will be to minimize the permanent impacts associated with the Project through a systematic revegetation program for disturbed areas. There will be some temporary impacts during construction of the Project. These impacts will be associated with the wider (32-foot) roads needed for the assembly crane to travel between turbine clearings and the approximately 315-foot diameter clearings required for assembly of the turbine rotors. In addition, with the exception of the base of the turbine, the driveway and the 70-foot by 83-foot crane pads, the turbine clearing areas will be mulched and allowed to revegetate.

The impacts to site hydrology from the proposed Project will also be minimized by the use of appropriate stormwater management BMPs such as culverts with outlet protection and level spreaders. State soil scientists promote the use of a "rock sandwich" design that allows water presently flowing from uphill areas to continue flowing under the road in a thin layer of coarse rock. This technique is superior to culverts in some instances because the flows are distributed instead of concentrated, minimizing the potential for erosion. Rock sandwich construction will be used as appropriate in areas where there are seeps or other hydrologic conditions that warrant its application. If culverts are found to be necessary in some areas, their outlets will be protected by rip rap aprons and level spreaders to dissipate concentrated flows. Where ditches are required (primarily in areas of cut), they will outlet to ditch turnouts with level spreaders as suggested by the Maine Department of Environmental Protection (MDEP) design criteria. MDEP design criteria require a ditch turnout ending with a level spreader every 250 feet if both sides of a crowned road are being diverted, and every 400 feet if only one side of the road is discharged through the ditch and level spreader. In areas of long deep cuts, MDEP has found that the creation of the level spreaders themselves are an unnecessary disturbance, and thus the agency has allowed longer runs and oversized spreaders at the end of the cut section. Utilizing these BMPs, we anticipate no significant water quality impacts to Ellis Pond or other watersheds.

Methodology
Criteria used to establish a viable stormwater management scheme were:

- Maintain existing flow paths and discharge points as much as possible;
- Cause no adverse impact of the peak runoff flow rates beyond the property line due to post-development conditions for a 25-, 10- and 2-year return period storms;
- Provide MDEP prescribed levels of water quality treatment for a minimum of 75 percent of the roadway and developed area; and
- Avoid disturbance of existing wetlands to the maximum extent possible.

Peak runoff flow rates and reservoir routing were determined using the TR-20 based HydroCAD Stormwater Modeling System by Applied Microcomputer Systems.

Peak runoff flow rates were obtained by implementing the runoff curve numbers (RCN's) determined by ground cover and soil types (from NRCS online mapping), and times of concentration (Tc's) determined by the distance and velocities of drainage patterns. RCN's and Tc's are then incorporated with the anticipated rainfall amount during a particular rainfall event to produce a unit hydrograph. This portion of

Oxford County (east) experiences Type II storms as defined by SCS. The 24-hour rainfall amounts evaluated and their recurrence intervals are 2.5 inches for a 2-year storm, 4.6 inches for a 10-year storm, and 5.3 inches for a 25-year storm.

Soils found on the site were predominantly Hydrologic Group C and D soils.

Assumptions Used in Modeling
The pre-development watershed study assumes an undeveloped site (see pre-development watershed plan). Tc's for areas within the proposed site were determined based on contour information. Refer to the attached plan entitled "Pre-Development Drainage Plan" for illustration of existing watershed area, hydraulic Tc's length lines, and physical features.

Alterations to Land Cover
Alterations to land cover will be consistent with the development of wind farm and access roads. Developed areas of existing roads will be regraded, consisting of flatter, smoother slopes, and final road and project surface areas will consist of gravel roads and turbine areas.

Existing Conditions
Land cover for the area proposed for development consists of primarily wooded areas. There are a variety of slops generally downhill from the proposed development at the mountaintop. The project watershed is divided into six sub-areas draining to a various locations. There are two lake watersheds, Ellis Pond and Bunker Pond.

Runoff flow rates were determined in cubic feet per second (cfs) for the 2-, 10- and 25-year, 24-hour storm events for the pre-development condition.

Proposed Conditions
Alterations associated with the post-development conditions consist of gravel roads and gravel turbine pad areas.

The post-development watershed was still divided into six subcatchments. The relative amount of disturbance from the development in each watershed was minimal. There was no difference in the drainage area going to each watershed and the model was adjusted to add the different land cover (gravel) associated with the proposed development. Small increases in flow were noted as a result of an increased Curve Number and rerouted Tc lines.

Runoff peak flow rates were again determined for the 2-, 10- and 25-year, 24-hour storm events and are expressed in cfs.

Summary
The following tables summarize the results of pre-development and post-development stormwater peak flow rates for the 25-, 10- and 2-year, 24-hour storm events. Also shown are the percent changes in flow rate for each subcatchment.

Stormwater Modeling Summary

25-year storm

Subcatchment	Area (acres)	Pre-Dev (cfs)	weighted CN	Post-Dev (cfs)	weighted CN	Change (cfs)	Change (percent)	New Gravel Area (ac.)
1	14313	2742	59	2914	60	172	6.3	10.16
2 *	5557	8526	68	8781	68	255	3.0	40.73
R4	38664	18023		18071		48	0.3	34.29
3	included in R4 above		62		62			0.83
4	included in R4 above		66		66			32.68
5 **	included in R4 above		62		62			0.78
6	2707	3981	68	3981	68	0	0.0	14.04
total	61241	33272		33747		475	1.4	

* Subcatchment 2 drains to Ellis Pond ** Subcatchment 5 drains to Bunker Pond

The following tables show the results for the 10- and 2-year storms.

10-year storm

Subcatchment	Area (acres)	Pre-Dev (cfs)	weighted CN	Post-Dev (cfs)	weighted CN	Change (cfs)	Change (percent)
1	14313	1901	59	2039	60	138	7.3
2	5557	6353	68	6537	68	184	2.9
R4	38664	12808		12838		30	0.2
3	included in R4 above		62		62		
4	included in R4 above		66		66		
5	included in R4 above		62		62		
6	2707	2965	68	2965	68	0	0.0
total	61241	24027		24379		352	1.5

2-year storm

Subcatchment	Area (acres)	Pre-Dev (cfs)	weighted CN	Post-Dev (cfs)	weighted CN	Change (cfs)	Change (percent)
1	14313	474	59	535	60	61	12.9
2	5557	2094	68	2162	68	68	3.2
R4	38664	3484		3489		5	0.1
3	included in R4 above		62		62		
4	included in R4 above		66		66		
5	included in R4 above		62		62		
6	2707	977	68	977	68	0	0.0
total	61241	7029		7163		134	1.9

Conclusions
Based upon results of the above analysis, it can be concluded that no significant increase in discharge rate from the site will be created. No adverse impact to adjacent waterbodies and/or properties will occur upon the implementation of stormwater management schemes depicted on referenced drainage plans.

See Pre- and Post-Development Watershed plans for illustrations of watershed areas, hydraulic lengths lines, and physical features. Calculations for drainage system sizing are provided in the attached computer printouts generated by HydroCAD.

Attached as Appendix 12-1 are HydroCAD printouts that include the following.

Curve number computations
Tc calculations
Travel time calculations
Peak discharge calculations
Reservoir routing calculations
Velocity calculations

Phosphorus Analysis
The following describes the phosphorus loading to Ellis Pond for the Record Hill Wind project. A small part of the turbine-12 pad is also in the Bunker Pond watershed. This small portion of the project is planned to be completely revegetated, so no calculations are being made for this temporary impact.

The phosphorus analysis is based on several assumptions listed in this narrative and specific analytical methods described in "Phosphorus Control in Lake Watersheds: A Technical Guide to Evaluating New Development" published in January 2008 by the MDEP.

Data on the lake's current water quality and allowable loading were obtained from MDEP on November 4, 2008. They calculated a pound per acre phosphorus allocation (P) of 0.041 pounds/acre. Further, they indicated that 3,496 acres in Roxbury are in the direct watershed of Ellis Pond. The Small Watershed Threshold is 163 acres.

Using this value of P, and an arbitrarily selected area of 132.03 acres for the entire development,[1] a Permitted Phosphorus Export (PPE) of 5.413 pounds/year was calculated. The area used to calculate phosphorus loading is less than the area the applicant controls in the watershed and reflects his intent to keep much of the site in an undeveloped condition.

The post-development calculation on the attached Worksheet 2 was prepared using a permanent gravel area of 9.111 acres of gravel roads and crane pads that will remain on the site once revegetation occurs at the end of construction in the Ellis Pond Watershed. This calculation demonstrates that the currently proposed development will result in a phosphorus loading of 4.783 pounds/year, which is less than the 5.413 pounds/year PPE. Therefore, the provided phosphorus treatment exceeds state (i.e., MDEP) requirements.

Phosphorus treatment will be accomplished by extensive forested and roadside buffering. Roads have been super elevated to drain surface water from the road to the downhill ditch or fill slope. This allows the road surface runoff to be treated either by sheet-flow roadside buffers or by ditch turnouts. Using these methods, Record Hill Wind LLC has been able to treat runoff from 92.7 percent of the roads and turbine areas. This exceeds the required 75 percent standard for a linear project. A calculation demonstrating

[1] This "development" area was determined by adding a 100-ft wide Phosphorus Restriction Area on each side of the road (measured from the toe of slopes outward) and turbine pads that fall within the direct Ellis Pond watershed. This totaled about 111 acres. The additional 21 acres is the footprint of the development and vegetated buffers in the indirect watershed north of the direct watershed. This restriction area is shown on the two 11x17 sketches included in this section. Areas previously disturbed during logging operations have been excluded from buffers.

this calculation and indicating which buffers will treat each section of road is included at the end of this section.

Fifty-five-foot-wide forested roadside buffers will be maintained wherever grading will permit sheet flow runoff from the access and crane path roads. Where sheet flow is not possible, stormwater running off the roads will be collected in ditches on the downhill side of the roads. These ditches will then be periodically discharged to the mountainside via ditch turnouts and 100-foot buffers. One-hundred-foot wide buffers will also be utilized around appropriate turbine pad grading.

Water running down the mountainside uphill of the roads and development will be collected in the upstream ditches of the road and allowed to pass under the road periodically via culverts or will be diverted around the ends of development grading. Water exiting culverts will go to level spreaders to redistribute it as sheet flow before being discharged down the remainder of the mountain. Stormwater entering the developed area in channel flow (streams) will be discharged to the downstream remainder of the stream after passing a riprap apron for energy dissipation.

In addition to the standard roadside buffers, the section of the access road from station 53+50 to where it meets the crane path road, and the crane path from stations 21+50 to 97+00 are in the Ellis Pond watershed. The phosphorus restriction zone also includes a portion of turbine pads 8 though 20 that are within the watershed. In these areas, a 100-foot-wide phosphorus restriction area has been created on each side of the road and turbines. This area begins at the grading limits and extends away from the project. While selective cutting of vegetation will be allowed in this area, no grubbing, soil disturbance or additional development is permitted.

Beginning at crane path station 99+14 and extending to the northern end of the proposed project, the phosphorus restriction zone will be the same area as the roadside, turbine, and ditch turnout buffers. This is because this portion of the watershed is only an indirect contributor to Ellis Pond after flowing through several streams.

Maintenance of Common Facilities or Property
Facilities requiring regular maintenance at the project include the stormwater management system and parking areas. Following are maintenance requirements that will be included in this project.

The entity responsible for ensuring that maintenance will be completed in a timely manner is the Owner. During construction, the prime contractor, who has yet to be determined, will have this responsibility.

Long Term Maintenance Plan
At a minimum, inspect two times annually on or about May 1 and November 1 and after severe storms.

1. Ditches
   a. Rip-rap lined ditches
      - Inspect semi-annually.
      - Remove sediment buildup, leaves, litter or other debris from the bottom and side slopes.
      - Reposition stones to restore channel to original dimensions.
   b. Vegetated Ditches
      - Inspect the ditch lining monthly for slumping of the lining, downcutting of the ditches base, or undercutting of the banks.
      - Repair any damage immediately.
      - Mow or brush-cut annually to prevent the establishment of woody vegetation

2. Culverts
      - Inspect for sediment buildup.
      - Flush pipes and remove sediment at which time the depth of sediment at any location in the pipe exceeds 3 inches.

3. Rip-Rap Aprons, Level Spreaders and Ditch Turnouts
   - Inspect semi-annually or after severe storms for dislodged stones or slumping of the stone lining.
   - Reposition stones to restore the pools original dimensions and a uniform surface.
   - Clean any accumulated sediments and debris from the plunge pool.
   - Cut and remove any woody vegetation growing within the pool.

4. Vegetation
   - Inspect vegetated areas each spring.
   - Re-seed and mulch areas where cover is less than 90 percent.
   - Rework, seed and mulch areas that have spotty plant germination and are sparsely vegetated, or where soil erosion is evident.

5. Stones Check Dams
   a. Prior to establishment of permanent vegetation
      - Inspect check dams after each storm event until permanent vegetation is established.
      - Remove sediment buildup behind check dams.
   b. After establishment of permanent vegetation
      - Inspect for sediment build-up in void space between stones and dislodged stones.
      - Remove sediment build-up.
      - Seed and mulch disturbed areas.
      - Replace check dam if sediment is filling void space.
      - Replace dislodged stones.

6. Road Grading
   - Grade the road to maintain the proposed roadway crown and to prevent the creation of berms or ruts that may channelize flow.

<u>Minimum Annual Maintenance</u>

1. Side slopes of gravel surfaces:
   - Inspect slopes for rill erosion due to concentrated flows.
   - Replace topsoil and reseed eroded slopes.

2. Level Spreaders and Ditch Turnouts
   - Inspect and verify that top of stone is level (+/-1").
   - Repair level lip to distribute flows uniformly across the buffer
   - Inspect stone to ensure that it remains clean, free of sediment and in place as designed.
   - Remove sediments. Replace any dislodged stone and maintain lip level to disperse flows uniformly across buffer area.

Inspection and Maintenance Log of Stormwater Structures

Month of ___________________, 20___

Structure	Date	Checked by	Comments

Section 14
Basic Standards

1.0 Introduction

The following plan has been developed to provide a strategy for controlling sedimentation and erosion from this project during and after construction of roadways, staging areas, and turbine pads. This plan is based upon sound conservation practices such as those outlined in the "*Maine Erosion and Sediment Control BMPS Manual* by the Maine Department of Environmental Protection (MDEP), dated March 2003, and recent experience constructing the Stetson Wind Project. Please refer to the Erosion Control Drawings and Details included within the Drawing Set for more detailed information (see Exhibit 1, sheets C-115 to C-122). For additional information on buffers the contractor shall reference Stormwater Management for Maine Volume III January 2006: BMPs Technical Design Manual Chapter 5, Vegetated Buffers.

Record Hill Wind LLC (RHW) is proposing to construct a series of wind turbines on Partridge Peak, Flathead Mountain, and associated ridges in Oxford County. The Project will include the construction of an access road to the turbines and the construction of turbine pad areas. Additionally, an Operations and Maintenance Building will be constructed. Erosion and sedimentation control during the construction of roadways and turbine pads is found on sheets C-115 to C-122 of the drawings. The location of the facility is shown on the Project Site map attached in Section 1 of the application. The Project scope, locations and methods of erosion control practices and measures required for the turbine construction are found in Exhibit 1.

1.1 Stormwater Management Measures

Additional measures may be required to protect new stormwater conveyance or management systems. It is also very important to protect new ditches, and culverts with special measures such as stone check dams, or similar measures to prevent sediment from entering conveyance systems and being transported long distances or to off-site locations.

1.2 Additional Permits

Work requiring additional permits, including local permits from towns or municipalities, shall be performed in accordance with all applicable standards therein.

2.0 Construction Calendar

2.1 General

Construction of the Project is expected to begin shortly after obtaining approvals and permits. It is likely that the construction of the roadways and turbine facilities will be fully complete in 2010. However, unanticipated delays, scheduling problems, or weather conditions may significantly alter these dates. The Contractor should give special attention to the sections pertaining to fall and winter construction, as well as to sensitive areas and requirements for temporary seeding, dormant seeding and mulching.

2.2 Definitions

The following definitions are terms commonly used throughout this report.

Seasons – The following dates define the seasons as referred to herein:

Seasons	**Dates***
Winter	November 1st to April 15th
Mud-Season	March 16th to April 30th *
Spring	May 1st to June 14th *
Summer	June 15th to September 15th *
Fall	September 16th to October 31st

*Seasonal dates may vary according to weather. The Engineer or MDEP must approve any changes in these dates.

Critical Areas – Specific areas identified herein or subjected to significant erosion problems as observed in the field prior to, during or following construction activities, such as areas with steep slopes or channels in excess of 8 percent, newly graded slopes, highly erodible soils that will be exposed for more than one month, or bare soils exposed during late fall and winter when no vegetation can grow.

Erosion and Sedimentation Controls – Defined as the installation of silt fence, hay bales, erosion control berms, rip-rap, mulching, erosion control matting or netting, check dams, inlet protection, construction entrances, diversions, level spreaders, and any other temporary or permanent measures required herein.

Clearing – Includes cutting and removing of over-story vegetative cover. It does not include grubbing. Limited cutting, thinning, use of heavy equipment and other clearing restrictions will apply to sensitive areas and wetland crossings.

Grubbing – The removal of grass, roots and scrub required to begin earthwork. Grubbing is the initial clearing action that exposes soil to erosive forces (wind, rain).

Interim Period – A period of time that an unvegetated area sits un-worked, awaiting the next phase of work.

Earthwork – Consists of the movement of soil by mechanical means including excavation, filling, grading, trenching, and shaping.

Temporary – As used herein shall refer to the use or placement of erosion or sedimentation controls, seeding or other measures intended to be either removed, replaced, reworked, reseeded, or followed with permanent measures.

Permanent or Final – As used herein shall refer to the use or placement of erosion or sedimentation controls, seeding or other measures, which will remain through final project completion.

Acceptance – As used herein shall mean verification by Owner and/or Engineer that the specific erosion control measure or device to be accepted is adequately constructed, performs satisfactorily as intended and is complete. Acceptance of a measure or device by Owner or Engineer shall be based upon visual observations and inspection and is not a warranty of compliance, compaction, structural integrity, workmanship or other construction related or qualitative factors that may require testing or other means of certification of compliance.

Engineer – As used herein shall mean a representative of James W. Sewall Co. and/or an engineer, representative or inspector designated by MDEP, or person designated by Owner as the Construction Site Engineer.

Buffer strips – Natural, undisturbed strips of natural vegetation or reseeded strips of close-growing vegetation adjacent to and downslope of developed areas. Reference: Stormwater Management for Maine Volume III January 2006: BMPs Technical Design Manual Chapter 5, Vegetated Buffers.

- Buffer with stone bermed level lip spreaders: This buffer is used for larger, developed areas and uses a level spreader to create sheet flow onto the buffer.
- Buffer adjacent to the down hill side of a road: This buffer is used for flow from a roadway when it directly enters the buffer as sheet flow.
- Ditch turn-out buffer: This buffer is used to divert roadway runoff collected in a ditch into a buffer as sheet flow.

2.3 Schedule of Activities

The following activities, erosion control measures, or other items are required for the construction of this project or require specific measures or scheduling of activities to be conducted or restricted during the various construction seasons as herein defined above.

Critical Areas – Work proposed in the defined critical areas may be conducted all year. However, to the extent practical, erosion control measures for defined critical areas should be installed during summer or fall in advance of construction, in or adjacent to critical areas anticipated or scheduled in the winter and mud season. Certain problem areas may become "critical areas" during the course of construction. Areas observed to be experiencing significant erosion problems shall be deemed critical areas and shall be stabilized with appropriate erosion control measures immediately prior to progressing with work in these areas as directed by Engineer.

Erosion and Sedimentation Controls Installation – Erosion control installation may occur all year long, except that such measures shall be installed prior to commencement of disturbance activities related to each erosion control measure. However, to the extent practical, erosion control measures should be installed during summer or fall in advance of construction anticipated or scheduled in the winter and mud season. See Drawings and Details for locations and installation procedures.

Clearing – Ground conditions permitting, clearing may occur at any time of the year.

Road Construction – This construction may occur in the spring, summer, and fall seasons. It may be allowed in the winter season. However, the winter construction schedule must be followed. The following requirement for access road construction will be adhered to in order to prevent erosion from taking place during construction:

- While the entire road system may be cleared in one effort, the access road will be constructed in segments where each segment is grubbed, constructed and protected prior to clearing the next segment. This construction sequence is intended to prevent large areas from being exposed, without temporary stabilization, to erosion during major rain events. A segment is defined as and area cleared and grubbed. Each segment shall not exceed a length that can be stabilized in a one-week period. Multiple segments in different areas of the project may be construction concurrently.

3.0 Erosion Control Measures

3.1 General

The construction of this Project may require or incorporate the following measures or practices as needed or applicable. Such measures, where indicated on Drawings, shall be implemented as shown, or as deemed necessary by the Engineer. Additional measures not shown on Drawings may be required as specified herein or requested by the Engineer, as needed, in order to ensure the protection of resources or off-site properties.

Straw Bales – Shall be installed along the contours in the locations and as detailed on the Drawings. Straw bales may be required in addition to silt fencing or other measures in sensitive areas as shown on Drawings. Bales are to be embedded four inches into the existing soil and staked with ends tightly abutting adjacent bales. Where staking and embedding of straw (or hay) bales is impractical due to excessive roots, ledge, or other construction hazards, straw bale barriers may be substituted with erosion control mix berms where approved by Engineer.

Erosion Control Mix Berms – May be installed in locations that do not have a concentrated flow.

Silt Fence – Shall be installed along the contours in the locations and as detailed on the Drawings. Silt fence may be required in additional, or other locations, not indicated on Drawings, as warranted or determined by field conditions or as directed by Engineer. Silt fence may also be required in addition to straw bales or other measures in sensitive areas as shown on Drawings. Where staking and embedding fabric is impractical due to excessive roots, ledge, or other construction hazards, silt fence may be substituted with erosion control mix berms or placement of six inches of suitable non-organic material along fabric flap on upslope side of fence, in lieu of burying fabric in trench, only where approved by Engineer.

Storm Drain Inlet Protection – Temporary storm drain drop inlet or curb inlet barriers shall be used on all storm drain inlets unless otherwise indicated on Drawings to prevent sediment from entering the storm drain system during construction. The intent is to provide a continuous sediment filter around the storm drain inlets. The filter may be constructed of silt fence, crushed stone, gravel, concrete blocks, hay bales, geotextiles or other proprietary products as detailed on the Drawings.

Sediment Barrier Berms - A sediment barrier is a berm installed across or at the toe of a slope and down gradient of disturbed earth. Its purpose is to intercept and retain small amounts of sediment from disturbed or unprotected areas of limited extent. (For other sediment barrier use, see MDEP BMP handbook section 14.0.) The sediment barrier is used where:

- Sedimentation can pollute or degrade a wetland or any other water resource.
- Sedimentation will reduce the capacity of storm drainage systems or dversely flood adjacent areas
- The contributing drainage area does not exceed 1/4 acre per 100 ft of barrier length; the maximum length of slope above the barrier is 100 feet; and the maximum gradient behind the barrier is 50 percent (2:1). If the slope length is greater, additional measures such as diversions may be necessary to reduce that length.
- Sediment barriers cannot be used in areas of concentrated flows. *Under no circumstances* should erosion control mix sediment barriers be constructed in streams or in swales.

Temporary Mulching – Shall consist of spreading of straw (or hay) mulch over bare or disturbed areas. It shall be applied at the rates described herein. It will be substituted by matting where necessary or as specified herein. Alternate mulch materials or methods such as hydro seeding may be used only when approved by the Engineer. Mulching shall be substituted with matting in locations where it has proven to be ineffective in the field. Mulching rates shall be doubled where requested by Engineer based on observations in the field or in locations undergoing winter construction.

Matting – Shall consist of straw, coconut or excelsior sandwiched between photodegradable netting. Matting may be substituted with sod where desired. Netting over straw mulch may be substituted for matting only when approved by Engineer. Matting shall be used: (1) where indicated on Drawings; (2) in the base of swales with moderate slopes and erosive capability. High velocity ditch lining or geotextile soft armor may be required in steep ditches (> 8%) or areas receiving significant concentrated flows; (3) on steep slopes where rilling may occur or where mulching has proven to be ineffective in the field; or (4) where straw mulch has been determined to be ineffective based on observations made in the field or as directed by the Engineer.

Riprap – Shall be used in swales, steep slopes, pond spillways, and outlets as shown on Drawings to protect soils from excessive flow velocities. It shall be of the size and depths specified on the Drawings. Riprap may be required at locations where revegetation mating, high velocity ditch lining or soft armor is proven to be ineffective in the field as directed by Engineer.

Flared End Sections – Shall be installed on the inlets and outlets of culverts, field inlets and storm drain outlets where indicated on Drawings. Rip-rap inlet or outlet protection may be required in addition to

flared end sections in locations where indicated on Drawings and in locations where flared end sections have proven to be ineffective in the field as directed by Engineer.

Outlet Protection – Riprap outlets (aprons or plunge pools) shall be provided in locations where indicated on Drawings and Details, and in locations where flared end sections have proven to be inadequate to prevent scouring at the pipe outlet in the Field, as directed by Engineer. The riprap shall be the same size as that specified on the Drawings.

Stone Check Dams – Shall be installed in existing and proposed swales or at culvert inlets as shown on the Drawings. These check dams serve to reduce flow velocities in swales thus helping to reduce rilling. Check dams shall be constructed with a six-inch tapered spillway at the center as shown on Details to prevent breaching and scour at the outer edges along the sides of the ditch.

Level Lip Spreader – Unless otherwise specified or indicated on Drawings, level lip spreaders will generally consist of 25-foot long, 6-inch to 12-inch deep, stone-lined ponded areas discharging over a level berm through a well vegetated buffer area. These spreaders will function to disperse channelized flow into shallow sheet flow. Construction and length of level lip spreaders shall be as detailed on the Drawings.

Construction Entrance – A crushed stone-stabilized construction entrance will be installed wherever construction traffic will enter the public road system. The size, type, and locations of these shall be as shown and detailed in the Drawings. Entrances shall be constructed with a 6-inch minimum layer of 2-inch stone. Stone entrance shall be placed on geotextile fabric and shall include a minimum 10-foot by 10 foot taper on both sides of the entrance to allow for turning vehicles.

Dust Control – Contractor shall take necessary steps to prevent blowing and airborne movement of dust from exposed soil surfaces. Maintaining natural or temporary vegetation and or mulching shall be used where practical. Mechanical sweepers or washing of pavement shall be used where necessary to prevent and remove dust buildup on paved surfaces. Regularly traveled soil surfaces shall be maintained to minimize dust by periodically moistening bare areas with adequate water to prevent dust. Calcium Chloride solution spray should be used in areas experiencing significant dust problems and to reduce frequency of watering. Repetitive treatment shall be applied as necessary to accomplish adequate dust control (refer to Section 17.0 in the *"Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices"* manual).

Permanent Mulching and Revegetation - Permanent mulch is long-term cover that provides a good buffer around disturbed areas. Permanent mulching with erosion control mix can be used as a permanent ground cover, as an overwinter stabilization mulch, or left to naturalize and revegetate to near natural conditions. It is not used to support grass vegetation, but legumes or woody vegetation may be established if allowed to revert to natural conditions. Permanent mulch must not be used in areas of concentrated water flows, and any evidence of groundwater seepage on slopes may require the erosion control mix to be replaced with riprap. Erosion control mix can be manufactured on or off the project site. It shall consist primarily of organic material, separated at the point of generation and may include shredded bark, stump grindings, composted bark, or flume grit and fragmented wood generated from water-flume log handling systems. Wood chips, ground construction debris, reprocessed wood products, or bark chips will not be acceptable as the organic component of the mix. Erosion control mix shall contain a well-graded mixture of particle sizes and may contain rocks less than four inches in diameter. Erosion control mix must be free of refuse, physical contaminants, and material toxic to plant growth.

4.0 Erosion Control Execution

4.1 General Construction Phase

The following general practices will be used to prevent erosion during construction of this project. Refer to Drawings and Details for applications, locations and installation methods. If Contractor is unclear regarding the use, location, installation, intended performance, or maintenance of any prescribed erosion

control measures, Contractor shall refer to the *"Maine Erosion and Sediment Control Handbook for Construction: BMP"* Manual for detailed procedures or contact Engineer for assistance.

NOTE: Locations of silt fence/hay-bale barriers are shown on Drawings for general purposes only to indicate the intent. Final locations should be modified based on actual field conditions and as site conditions warrant. Such field changes or modifications shall be approved by the Engineer.

Following clearing – Only those areas under active construction shall be left in an untreated or unvegetated condition.

Erosion Control Installation – Prior to the start of grubbing, silt fence, haybales, erosion control mix berms, stabilized construction entrances, or other appropriate measures shall be installed adjacent to construction areas, around catch basins, at the toe of slopes and in areas as shown on Drawings, or as otherwise required to protect against any construction related erosion. Immediately following construction of culverts and swales, stone check dams, and ditch linings shall be installed, as shown on the Drawings.

Topsoil – Topsoil will be stockpiled on-site when necessary in areas that have minimum potential for erosion, such as flat slopes or on-site borrow pits, and will be kept as far as possible from existing drainage areas. Stockpiles expected to remain longer than 15 days shall be encircled with haybales, erosion control mix berms, or silt fence at the down gradient sides of the stockpile; and mulched with a second application of hay mulch and anchored with biodegradable netting if deemed necessary by Engineer.

Temporary Seeding and Mulching Schedule – During construction, all disturbed areas shall adhere to the schedules specified in TABLE 1 and SEEDING SCHEDULE below: (Note: refer to Section 4.02-Permanent Seeding and Mulching Plan for permanent seeding and mulching requirements.).

The Contractor shall be responsible for monitoring daily weather reports when working in the identified sensitive areas and for monitoring weekly reports in other areas. Contractor shall adjust the work schedule in anticipation of rains and shall stabilize the site as indicated or required.

All completed areas that have been loamed and/or finish graded shall be permanently reseeded in accordance with Section 4.02-Permanent Seeding and Mulching Plan.

Temporary mulching and/or seeding shall commence immediately following initial fine grading of any area expected to remain bare for an interim period of more than 30 days (7 days for sensitive and critical areas). Stabilization or seeding requirements shall be determined in accordance with Table 1 and shall be implemented at the beginning of the expected interim period. In no case shall any bare areas remain untreated for more than 30 days (7 days for sensitive and critical areas).

Interim periods for sensitive and critical areas are indicated in the following tables. However, exposed or bare soil in these areas shall be mulched at the completion of work, each day, if significant rainfall is predicted or eminent.

Mulch application rate shall be doubled during winter construction. Where practicable, mulch should be applied at the end of each days work for areas that have been fine graded or if snow is predicted or eminent. In no case shall any areas be left bare for more than 15 days.

Permanent seeding shall not be attempted during the fall or winter seasons (after September 1) unless otherwise approved by Engineer. Should seeding be approved by Engineer during winter season, the Contractor shall follow procedures for dormant seeding. Refer to Section 4.02-Permanent Seeding and Mulching Plan for dormant seeding requirements. However, vegetation must be inspected and reseeded by Contractor as necessary in the following spring (April 15th) to ensure good vegetative cover. Acceptance of dormant seeding shall not occur until after May 1, in the following Spring.

Temporary seeding and mulch shall be inspected and maintained or repaired weekly. At a minimum, 75 percent of the soil surface should be covered by vegetation. If any evidence of erosion or sedimentation is apparent, repairs shall be made and other temporary measures used in the interim (e.g., mulch, filter barriers, check dams). Mulch shall be reapplied as necessary to completely cover soil.

Maximum Expected Interim Period* - (Days)	Temporary Mulching (Hay)	Temporary Seeding
0-7 (0-2)	None	None
7-30 (2-14)	2-bales/1000 sq.ft	None
30-60 (14-30)	2-bales/1000 sq.ft.	(Per temporary seeding schedule)
More than 7 days during winter season	4-bales/1000 sq.ft.	Dormant seeding only
* Values in parentheses indicates interim period for sensitive & critical areas. ** Mulch application rates shall be doubled for winter construction		

TEMPORARY SEEDING SCHEDULE			
Seed	Seeding Rate (Lbs/1000 sq. ft.)	Seeding Depth (Inches)	Recommended Seeding Dates
Annual Rye Grass	0.9	1/4	4/1 to 7/1
Sudan Grass	0.9	1/2	7/1 to 8/15
Perennial Rye Grass	1.8	1/4	8/15 to 9/15
Winter Rye Grass	2.6	1	9/15 to 10/15
Dormant Seeding 50% Winter Rye 50% Annual Rye	3.5 (2.6) (0.9)	1	10/15 to 3/31

Grading – Grading will be held to a maximum 2:1 slope where practical. Greater slopes may be used in ledge cut or stable material. Finish-graded areas shall be stabilized with permanent seeding and mulching or other accepted means immediately after final grading is complete. If final grading will not be completed immediately, refer to the Temporary Seeding and Mulching Schedule. It is understood that immediately means within five days of the completion of work. Refer to *Permanent Seeding and Mulching Plan*, herein. See Contract Specifications for additional, more specific, permanent seeding requirements.

Construction Traffic – Construction traffic will be directed over the stabilized construction entrances and proposed roads. Any areas subject to rutting will be stabilized immediately. The crushed stone construction entrances shall be maintained by the addition of more crushed stone as needed as the voids become filled. The public roadway shall be swept daily should mud be tracked onto it.

Winter Construction – For any work proposed during the winter season, the Contractor shall adhere to the following practices.

- A plan and schedule of activities shall be submitted to the Engineer and approved prior to any work being done.
- The interim period for any exposed area shall be limited to 7 calendar days.

- Where required and approved by Engineer, installation of silt fence may be modified from detail on Drawings to substitute six inches of suitable non-organic material over the bottom of the silt fence in lieu of trenching and backfilling fabric.
- Mulching and seeding rates shall adhere to the Temporary Seeding and Mulching Schedule, (Section 4.01.d.). *Note that all mulching rates shall be doubled as shown in the above table and shall follow the sensitive area schedule.*
- Permanent seeding shall not be attempted by Contractor during winter season unless otherwise approved by Engineer.

Monitoring Schedule – The Contractor shall be responsible for installing, monitoring, maintaining, repairing, replacing and/or removing the temporary erosion and sedimentation controls as specified herein or directed by the Engineer, or shall appoint a qualified subcontractor to do so, as follows:

- The Contractor or approved designated Inspector shall perform weekly inspections of the site until the site is stabilized. Inspections may be performed at a bi-weekly schedule while work has abated for more than one week.
- Maintenance measures will be performed as needed during the entire construction cycle. After each rainfall, and *prior to* predicted significant rainfall events (> 1"), a visual erosion controls inspection will be made by the Contractor to insure their continuing function as designed.
- Stone check dams, hay bale barriers, drop inlet barriers, erosion control mix berms, silt fence and mulch shall be inspected and repaired once a week or immediately following any significant rainfall. Sediment trapped behind these barriers shall be removed when it reaches a depth of 6 inches (or 1/2 the height of the dam for check dams) and redistributed to areas undergoing final grading.
- Near completion of the construction and after the site is reseeded and stabilized, the Contractor shall inspect, clean, maintain, repair, restabilize or revegetate all drainage structures, storm drains, culverts, level spreaders and ditches prior to acceptance by the Owner.

Permanent Seeding and Mulching Plan – The following general practices will be used to re-establish final vegetation.

- Loam will be spread over disturbed areas and graded to a uniform depth and a natural appearance. Loam shall be as specified or approved by the Engineer.
- Final seeding shall be completed immediately (within 7 days) following final topsoil and loam grading. All final fertilizing and seeding shall adhere to the Specifications unless otherwise approved by the Engineer. Refer to Specification Section 02930.
- Areas shall be mulched immediately after seeding. Immediately upon first signs of any evidence of significant erosion occurring, Contractor shall repair and mulch all such areas until area is stabilized. Mulching shall consist of hay mulch, hydro-mulch, or any suitable substitute deemed acceptable by the Engineer. Mulching shall be monitored according to the monitoring schedule. Should mulching prove to be ineffective, then netting or matting shall be used in its place.
- Straw mulch shall be applied at the rate of 2 tons per acre (90 pounds or 2 bales/1,000 square feet) unless otherwise specified.
- Hydro-mulch shall consist of a mixture of asphalt, wood fiber or paper fiber and water sprayed over a seeded area. Hydro-mulch shall not be used during the fall, winter or mud season unless approved by the Engineer.
- Construction shall be planned to the extent possible to minimize the need for seeding during the fall, winter or mud season. Dormant seeding shall not be used unless approved by Engineer. Should seeding be necessary between these dates, the following procedure shall be followed.
    - Only unfrozen loam shall be used.
    - Loaming, seeding and mulching will not be done over snow cover. If snow exists, it must be removed prior to placement of seed.
    - No permanent seeding will be done during fall, winter or mud season unless specifically approved by the Engineer. If attempted, the normal seed application rate shall be doubled. Reseeding in spring by Contractor will be required in all areas with insufficient growth.

- Where temporary seeding is required, the rates specified in the Temporary Seeding and Mulching Schedule shall be adhered.
- Fertilizing, seeding and mulching shall be done as soon as possible after the loam is spread. Winter mulch rates shall apply as specified in the temporary seeding and mulching schedule.
- On slopes greater than 3:1, straw matting or excelsior matting may be substituted for mulch. Biodegradable netting over mulch may be applied where required by the Engineer.

Following final seeding, the site will be inspected every 30 days until 80 percent cover has been established. Reseeding and mulching shall be carried out in areas where inadequate catch is observed until adequate growth is established in seeded areas, as agreed upon by the Engineer. The Contractor may be required to reseed during the following spring subsequent to winter or fall construction and seeding in order to provide 80 percent vegetative cover as required for Acceptance by Owner.

4.2 Erosion Control Removal

Removal of temporary erosion control measures shall be the responsibility of the Contractor. Erosion controls shall remain in place and maintained by the Contractor until all related construction is complete and the area is stable.

An area is considered stable if a 90 percent cover of grass has been established or riprap or other permanent measures are in place and functioning properly.

Haybales and silt fence shall be removed once the areas upstream are stable. The haybales and silt fence shall be disposed of legally and properly off-site. Sediment trapped behind these controls shall be distributed to an area undergoing final grading and Graded in an aesthetic manner to conform to the topography, and fertilized, seeded and mulched in accordance with the rates previously stated.

The sediment trapped behind/around/in stone check dams, perforated risers, and sedimentation basins, shall be removed and transported off-site, or to an upslope area undergoing final grading. The sediment trapped by these devices shall not be regraded locally since they exist in drainage ways.

The rip-rap and stone from the check dams and risers may be either removed or regraded in an aesthetic manner that does not inhibit flow or create erosion.

Once the trapped sediments have been removed from the temporary sedimentation devices, the disturbed areas must be loamed (if necessary), fertilized, seeded and mulched in accordance with the rates previously stated.

5.0 Conclusion

If constructed in conformance with the Project Drawings and the Erosion and Sedimentation Control Report, herein, the Project should not result in any significant erosion or sedimentation either on or off the site.